IVC 16 (16th International Vacuum Congress)
ICSS - 12 (12th International Conference on Solid Surfaces)
NANO - 8 (8th International Conference on Nanometer-Scale Science and Technology)
AIV - 17 (17th Vacuum National Symposium)

"Surface Science from the nanometer to the kilometer Range"

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Two topics in surface science will be discussed, spanning the length scale from nanometers to kilometers. The first concerns nanoscale faceting of surfaces: Faceting is a form of self-assembly, which occurs when an initially planar single-crystal surface converts to a "hill and valley" structure, exposing crystal faces of nanometer scale dimensions.Planar metal surfaces that are rough on the atomic scale, such as bcc (111) and fcc (210), are morphologically unstable when covered by monolayer films of oxygen, or of certain metals: they become "nanotextured" when heated to sufficiently high temperature [1, 2]. Faceting is driven by surface thermodynamics (anisotropy of surface free energy), but controlled by kinetics (diffusion, nucleation). Measurements include scanning tunnelling microsopy, STM, low-energy electron diffraction, LEED, and soft x-ray photoemission (SXPS) using synchrotron radiation. We discuss structural and electronic properties of the surfaces, conditions for surface alloy formation, and implications for structure-sensitive effects in catalysis; first principles calculations are compared with experimental observations.

The second topic concerns "far-out" surface science over long length scales in interplanetary space, a cosmic laboratory for surface and vacuum scientists. Energetic photons, ions and electrons from the solar wind, together with galactic and extragalactic cosmic rays, constantly bombard surfaces of planets, planetary satellites, comets and asteroids.
Smaller bodies exist in ultrahigh vacuum environments, so that direct particle-surface collisions dominate the interactions [3]. We discuss the origins of the very tenuous planetary atmospheres observed on a number of bodies, with a focus on the atmospheres of Na and K atoms surrounding the Moon, the planet Mercury, and Jupiter's icy satellite Europa. We describe experiments involving both thermal desorption and non-thermal processes (photon stimulated desorption (PSD) electron stimulated desorption (ESD), and ion sputtering) that cause desorption of alkali atoms from model mineral surfaces and from a lunar basalt sample obtained from NASA [4].
The data support the proposal that PSD by ultraviolet solar photons is a dominant source process for alkalis (Na, K) in the tenuous lunar atmosphere.

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[4] B. V. Yakshinskiy and T. E. Madey, Icarus, in press (2004).